Joe & Chris,

I asked Larry Hesse to provide input regarding several questions about the Gavins Point river reach and pallid sturgeon recovery. Larry's response is in the attached pdf file. Larry, was a member of the Committee on Missouri River Ecosystem Science, National Research Council (I have included additional information about Larry below).

Please share this with members of the Spring Rise Plenary, hydrology tech working group and pallid sturgeon tech working group,

<<Hesse1.pdf>>
Thank You

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Larry W. Hesse is the chief scientist and vice-president of River Ecosystems, Inc., and River Corporation, both located in Crofton, Nebraska. Mr. Hesse was previously employed as an aquatic research biologist and large river ecologist for the Nebraska Game and Parks Commission (1974-1994). Mr. Hesse's research experience has included work with the federal Upper Colorado River recovery program for endangered fish, as well as dozens of Missouri River fisheries studies for the federal government and private sector. He has authored roughly 100 journal papers, federal aid reports, books, and popular articles on Missouri River fisheries and water management. Mr. Hesse received his B. A. degree in ecology from Wayne State College and his M. A. degree in aquatic ecology from the University of South Dakota.

The Missouri River Ecosystem: Exploring the Prospects for Recovery
http://books.nap.edu/catalog/10277.html
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ROBERT G. WETZEL, University of North Carolina, Chapel Hill

River Ecosystems Inc.

Memo

To: ~~Wayne Nelson-Stastny~~

From: Larry Hesse LWH

CC: Gene Zuerlein

Date: 7/11/2005

Re: Response to your request

Scientists must learn to accept that it is reasonable and prudent that fundamental changes in the management of large ecosystems today should be carefully questioned since humans have come to rely on these altered systems. The changes aimed to recover historical attributes of the Missouri River ecosystem must be science based and defensible. Having said that there are some basic driving forces behind the evolution of this large river ecosystem.

My response to questions regarding the reach including the lowermost dams and the channelized portion to the Platte River: No mass extinctions of native fish have occurred as yet in the Missouri River, including the reaches downstream from Fort Randall Dam, although, abundance and species composition have changed. The catch per unit effort of many native species has declined and those species which were dominant at about the time damming and channelization was taking place have been replaced with new dominant species that were previously not abundant but still native. In addition, non-natives have been able to take over the role of dominant species in some areas, e.g., Asian carps including the common carp along the channelized sections and smallmouth bass in the unchannelized sections. This shift is probably due to the changes in hydrology and geomorphology of the river since the mid-1800s, which have provided conditions favorable for fringe species from the past and non-natives. Since the Missouri River is at least 150,000 years old in the upper unchannelized sections and millions of years old in the lower reaches, and the species present today are still mostly what was found there in the earliest recorded history, it is safe to assume these species evolved with the hydrology and geomorphology that predates human re-engineering. There is ample evidence to describe pre-settlement hydrology and geomorphology and it included flood pulses, periods of base flow, massive sediment transport, and channel meandering, each of which has been fundamentally altered. Pallid sturgeon lived and may still live in the unchannelized remnants upstream and downstream from Gavins Point Dam. Reference the photograph of an old pallid sturgeon caught on rod and reel at the mouth of the Niobrara River in 1973 by Ed Pearson, a Nebraska State Patrolman now retired (photo only sent to Wayne, Gene you should be able to get one from I&E, they had a copy made from my picture). This fish was not stocked it was trying to survive the changes in the river since the dams were built two decades earlier. It is quite likely that this 45 pound pallid may have been born about the time Gavins Point dam was closed or shortly thereafter. Since pallids did live historically in the reach in question it makes sense to restore conditions that made that possible in order to recover the species.

The Issue of Flow: I have been drift netting annually since about 1983. Drift nets are used to sample for larval (just hatched) fish entrained in the main channel current. Sturgeon larvae are quite rare because sturgeon adults are not abundant and because it is possible that conditions conducive to reproduction my not exist as often due to the altered hydrograph and mass transport. However, I have captured 25 larval sturgeons since 1983. These fish ranged in total length from 7 to 14 mm. In most cases these larvae retained the yolk sac. Since the yolk is absorbed quickly it is likely that these larvae were just a few days old at most. I am currently working with the University of Nebraska and PhD graduate student Chris Hay to model the relationship between larval fish abundance and abiotic factors such as flow and turbidity and draft results will be available soon. However, anecdotal evidence from my samples suggests a connection with flow. Four sturgeon larvae were collected in 1985 and 1986, which was a high discharge period pre-ceding the late 1980s drought (Table 1). One sturgeon larvae was collected in May in 1990 at South Sioux and Chart 1 shows a flow spike at Sioux City at about the right time to have signaled sturgeon to spawn. One sturgeon larvae was collected in May in 1991 at Niobrara. Chart 2 shows a lot of short duration flow spikes (probably peaking), which might have signaled an attempt to spawn. Two sturgeon larvae were collected at Brownville in June in 1999. Figure 4 shows flow spikes occurring during June in 1999 at Omaha. Six sturgeon larvae were collected in May and June in 2000 at Blair and Brownville. There was a rise in stage at Omaha in late May and a bigger spike in June in 2000 at Omaha (Figure 5). Five sturgeon larvae were collected in June in 2001 at several locations. The hydrograph in 2001 at Omaha almost resembled a natural hydrograph with flood pulse events occurring in April through May and then another short duration spike in June (Figure 6). Five sturgeon larvae were collected in June of 2002 and there was a May and June flow spike in 2002 (Figure 7). The last sturgeon larvae were collected in late June in 2004 at Nebraska City. Figure 2004 – 4 shows a significant high flow period throughout May and a spike in most of June. These observations suggest a linkage between rising stage and the production of sturgeon larvae.

The Issue of Sediment: Sturgeons evolved with predam turbidity, which was very high at times each year. The turbidity provided cover for young sturgeons, and the sediment, which created the turbidity, carried heavy loads of organic matter for invertebrate nutrition. Sturgeons eat invertebrates as larvae, juveniles and adults and eat other fish that also depend on invertebrates in their diet. Moreover, sediment was the raw material for mid-channel bars where sturgeons choose to live. Sediment has been stopped in the main stem reservoirs. Drawdown flushing can readily supply the Gavins Point reach with renewed sediment from that stored in Lewis and Clark Lake and minimal meandering can meet current sediment needs for the Fort Randall Reach for the short-term future. A large supply exists at the White River delta that is 30 miles upstream in Lake Francis Case from Fort Randall Dam. A sluice pipeline has been discussed to transport sediment through an equal or larger distance in Lewis and Clark Lake so it may be possible to fashion a pipeline to sluice these supplies past Fort Randall Dam from the White River confluence.

The Issue of Habitat: Pre-settlement Missouri River habitats were diverse and the result of natural flow and sediment within a channel capable of moving laterally (meandering). The Missouri River needs some limited to room to roam once again. A narrow meander belt does not have to be a threat to agriculture, industry, or housing. The channelized section, in particular, could be widened in a controlled fashion to allow the channel to migrate in a very small way creating appropriate habitats as it does. Maintenance of a navigation channel may conflict with this but it is essential that the river should be assisted to construct its own habitats with flow and sediment because man-made habitats have failed in the past and they will likely continue to fail because they do not include the essential components of increased flow and adequate sediment supply.

The Issue of non-native species impacts on pallid sturgeon and other native species: I can accept on principle that non-native species have a negative impact on native species. Within the reservoir reaches, fish managers have little choice but to use non-native forage species because natives did not have reservoirs to evolve in, and thus do not thrive in the man-made reservoirs that are omni-present. The fact that non-native forage feeds non-native game fish is the result of constructing the seven mainstem dams. Managing non-natives is about all the upper basin states have left. Having said that I see absolutely no evidence that non-natives from the reservoir reaches have any impact at all on the natives in the reach in question. I have collected only a very small number of smelt and spot-tailed shiner from the reach in question. I am much more concerned about the impact of massive populations of Asian carps, which have expanded throughout the reach. At the present time I am not aware of any viable method to eliminate them but I would suggest that recovering attributes of the natural hydrograph and sediment transport would mitigate their presence because these actions support the basic requirements for a healthy life of the native species assemblage. A robust native assemblage might challenge the existence of non-natives.

The National Research Council said it several years ago and I will repeat it now. Adoption of a semblance of the natural hydrograph, recovery of mass transport, room to roam, recovery of natural temperature regimes are the most critical components to recover the ecosystem. Without prompt action on these issues the native aquatic species will continue to decline in abundance and we do not know to what level they may decline before it becomes irreversible. It is time for implementation of a flood pulse, a base flow period, and sediment bypass where possible, now, within the framework of adaptive management. Monitoring is important and so is future adjustment to the plan adopted now, because what is most important is a response by the native species targeted, not the mere fact that some kind of experiment was implemented. Extinction is a one-way street. I have a hard time believing anyone wants that outcome.

Table 1. Larval sturgeon collected from the middle Missouri River Biomonitoring and Assessment Program. These data may not be reprinted or used for any purpose other than for use to assist in developing a flow experiment for Gavins Point Dam without written approval by Larry W. Hesse, Principal, River Ecosystems, Inc., Crofton, NE, (27 June 2005).

Sample #	Site	Year	Month	Day	Method	TL (mm)	Count	
5	Niobrara	1985	5	13	560μ net	7	1	
70	Wynot	1985	6	26	560μ net	9	1	
663	Tekamah	1986	5	15	560μ net	8	1	
671	Tekamah	1986	6	24	560μ net	12	1	
98	South Sioux	1990	5	17	560μ net		1	
156	Niobrara	1991	5	31	560μ net		1	
262	Brownville	1999	6	30	560μ net		2	
136	Brownville	2000	5	18	560μ net		1	
312	Brownville	2000	6	13	560μ net	11	1	
421	Blair	2000	6	28	560μ net		4	
230	Decatur	2001	6	13	560μ net	8	1	
222	Maskel	2001	6	13	560μ net	9	1	
259	Brownville	2001	6	14	560μ net		1	
259	Brownville	2001	6	14	560μ net	14	1	
325	St. Helena	2001	6	25	560μ net	8	1	
226	Maskel	2002	6	10	560μ net	10	1	
234	Decatur	2002	6	11	560μ net	7	1	
234	Decatur	2002	6	11	560μ net	7	1	
246	Nebr. City	2002	6	11	560μ net	9	1	
334	Decatur	2002	6	25	560μ net	9	1	
279	Fox Lake	2004	6	29	560μ net	14	1	

Chart 1. Discharge at Sioux City in 1990.

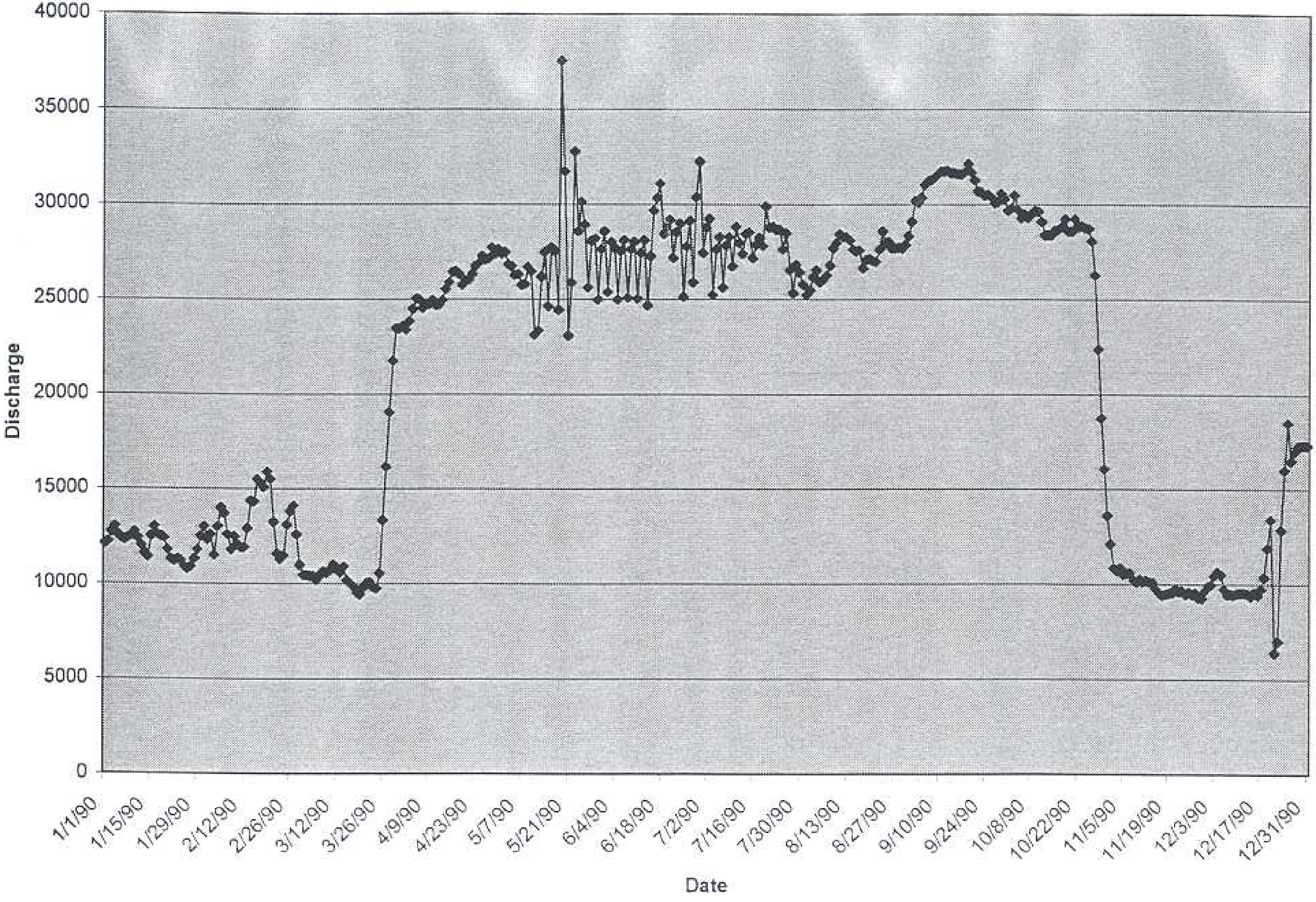

Chart 2. Discharge at Fort Randall in 1991.

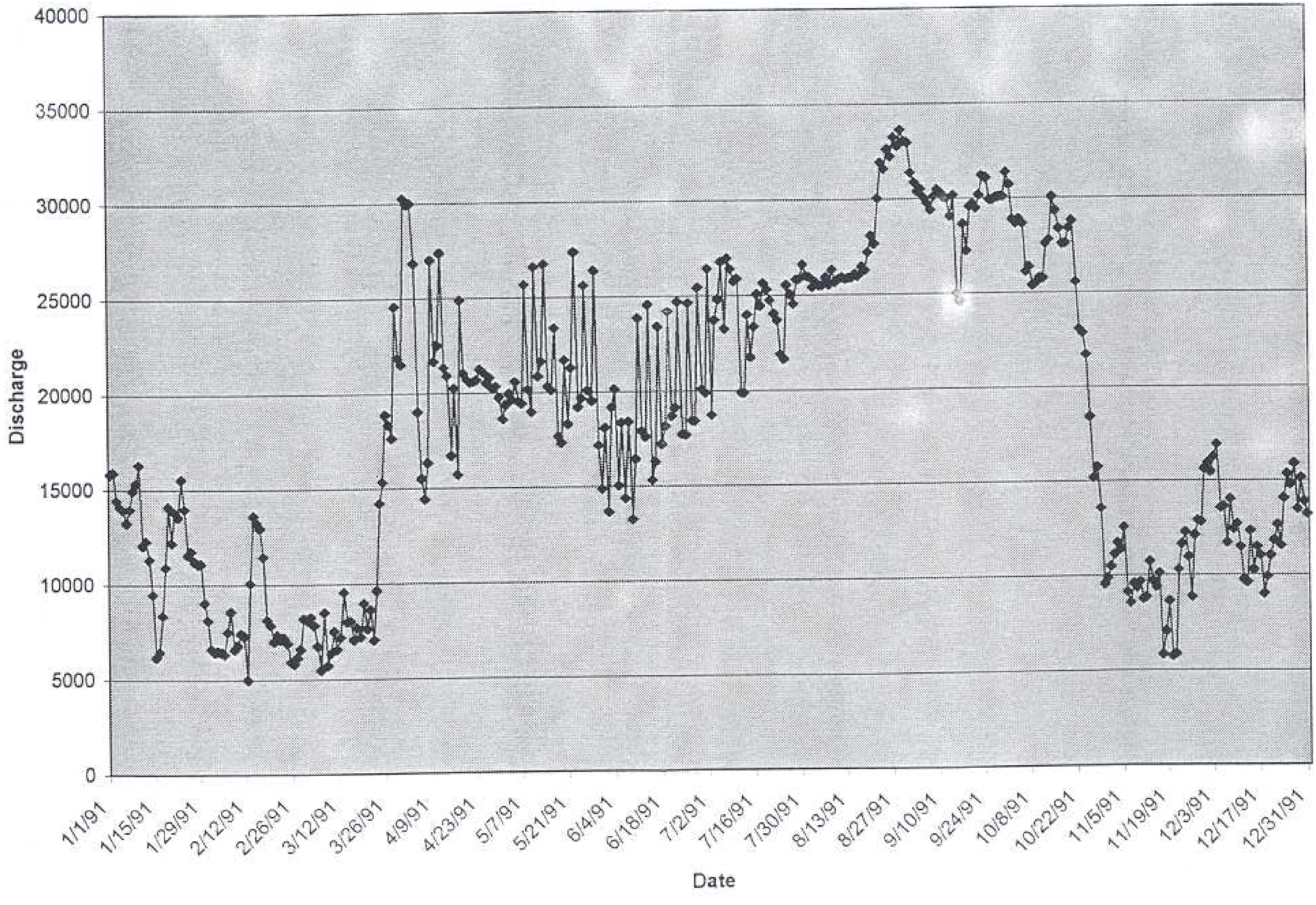

Figure 4. Volume discharge of the Missouri River at Omaha, NE during 1999.

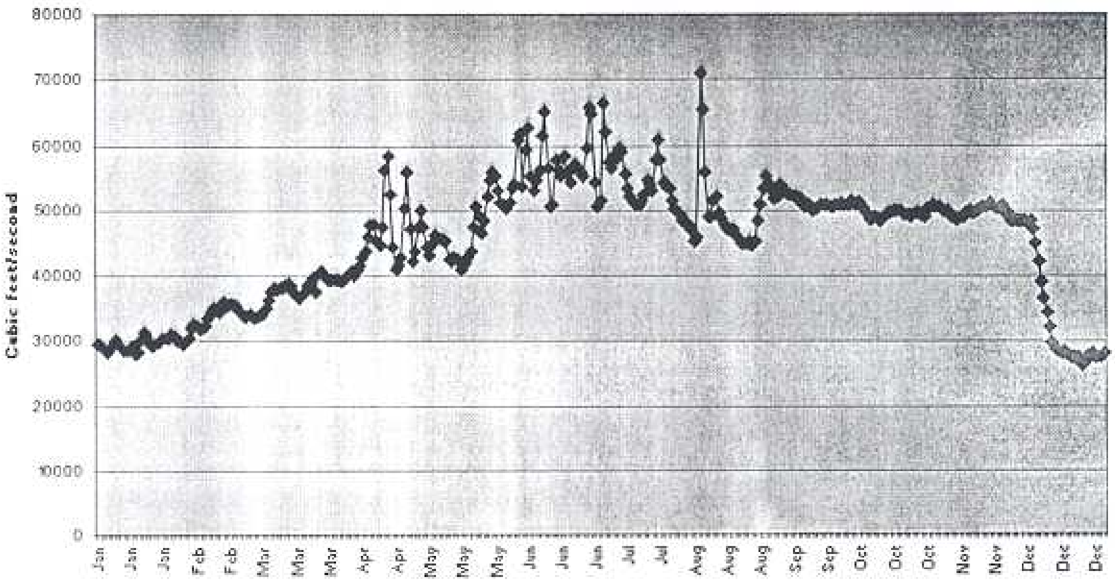

Figure 5. Volume discharge of the Missouri River at Omaha, NE during 2000.

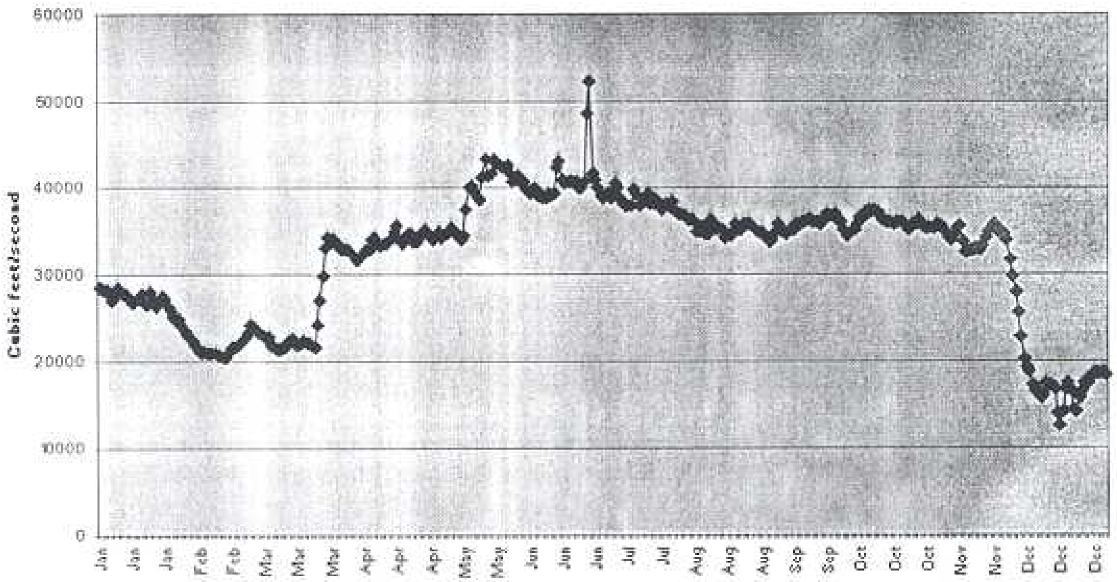

Figure 6. Volume discharge of the Missouri River at Omaha, NE during 2001.

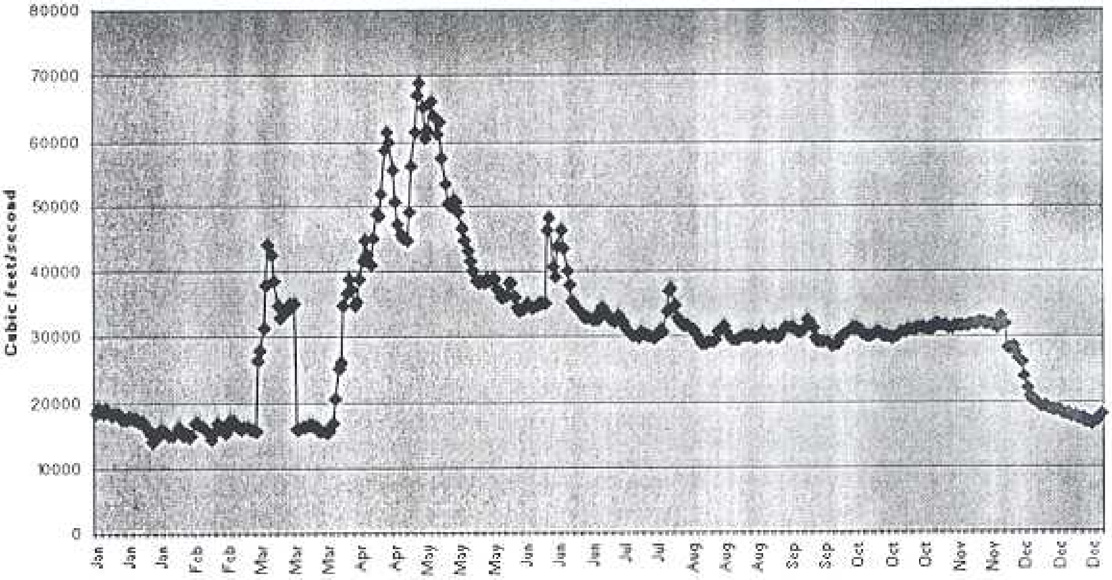

Figure 7. Volume discharge of the Missouri River at Omaha, NE during 2002.

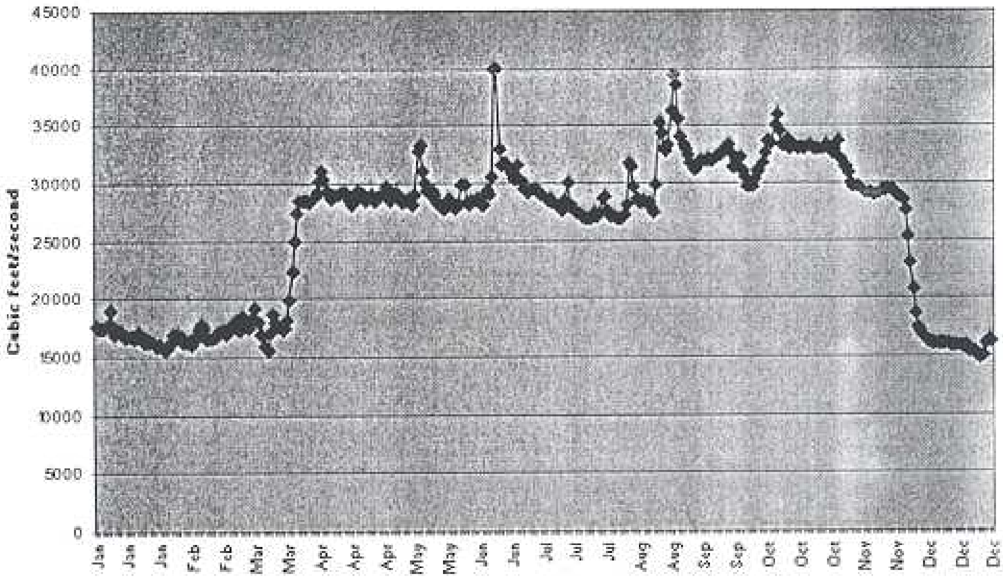

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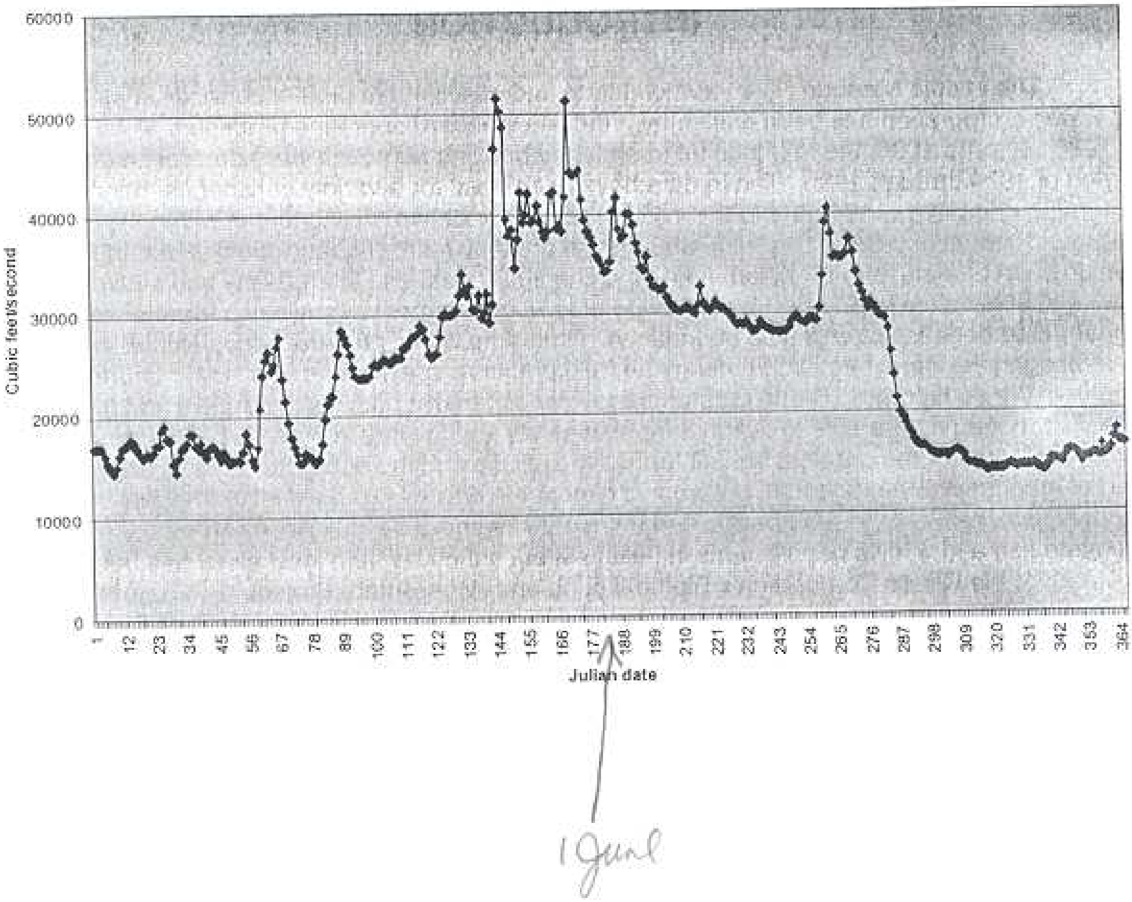
Figure 2004 - 4. Volume discharge of the Missouri River at Omaha, NE, 2004 water year.



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